



Saskatchewan
Research Council

AN ASSESSMENT PROCEDURE
FOR SASKATCHEWAN RANGELAND

Prepared for
Lands Branch
Saskatchewan Rural Development

by

Zoheir M. Abouguendia
Jeffrey P. Thorpe
Robert C. Godwin

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The Lands Branch of the Saskatchewan Department of Rural Development has identified the need for a province-wide native rangeland assessment procedure as part of a review of the formula used to establish grazing rentals on Crown land. The Saskatchewan Research Council, in cooperation with the University of Saskatchewan and the Saskatchewan Institute of Pedology, has developed a procedure based on existing data and a limited field survey. This publication describes the proposed approach and provides the background information necessary for its implementation. The development of the procedure is described in detail in Abouguendia et al. (1990).

The main goal of range management is to obtain maximum returns from the rangeland resources without adversely affecting forage production, forage quality or soil quality. Although rangeland assessment is a very important component of range management, it is merely one of the tools that help us achieve that ultimate objective of range management.

Proper range management is based on the principles of grazing management. The application of these principles requires certain kinds of information. This information pertains largely to the potential and present productivity of the range and is provided by the rangeland assessment process. More details on the above aspects can be found in Abouguendia (1990).

Potential productivity of the range is often expressed as grazing (or carrying) capacity. Grazing capacity represents the value of the range and can be defined as the average number of animals which can graze a range for a specific number of days without inducing range degradation. The concept of grazing capacity assumes proper grazing management of a nondegraded range. Grazing capacity depends on range site quality, type of vegetation and climatic characteristics.

Since rangelands are subject to various management regimes, modifications and disturbances, the present productivity may not necessarily be the same as the potential. It is, therefore, important also to determine the present state of the range. Range condition is the parameter or tool that relates the present productivity of the range to its natural potential productivity. The term "range condition" should not be confused with seasonal conditions, which may be wet or dry but do not alter the intrinsic "condition" or health of the range.

Stocking rate is the actual number of animals on a specific range area for a specific period of time, usually a grazing season. An indication of the possible stocking rate for a particular site can be obtained from grazing capacity estimates. It should be emphasized, however, that actual stocking rate depends on range condition, current season's precipitation, topography, grazing management and the availability of range facilities.

Figure 1 provides the framework for utilizing the range assessment tools in achieving the range manager's goal of maximum sustainable productivity. It shows that carrying capacity provides a starting point suggesting a possible stocking rate. An initial stocking rate can then be determined upon knowledge of range condition. The initial stocking rate may need to be adjusted on the basis of the grazing management practices and availability of range facilities. The actual stocking rate will depend on the current season's growth conditions. This is monitored every season by measuring or estimating utilization. In the long term, stocking rate adjustments should be made on the basis of monitoring trend in range condition.

3 ASSESSMENT PROCEDURE

The use of the procedure involves the following steps:

- (1) Determine soil type.
- (2) Identify range site.
- (3) Determine kind of vegetation.
- (4) Find grazing capacity value using the appropriate guide.
- (5) Calculate the total number of animal unit months (AUMs) for the site.
- (6) Convert the AUMs (from step 5) to animal months (AM) depending on the kind and class of animals.

Table 1 shows examples of grazing capacity estimates derived using the above procedure. The above steps are explained further in the following sections.

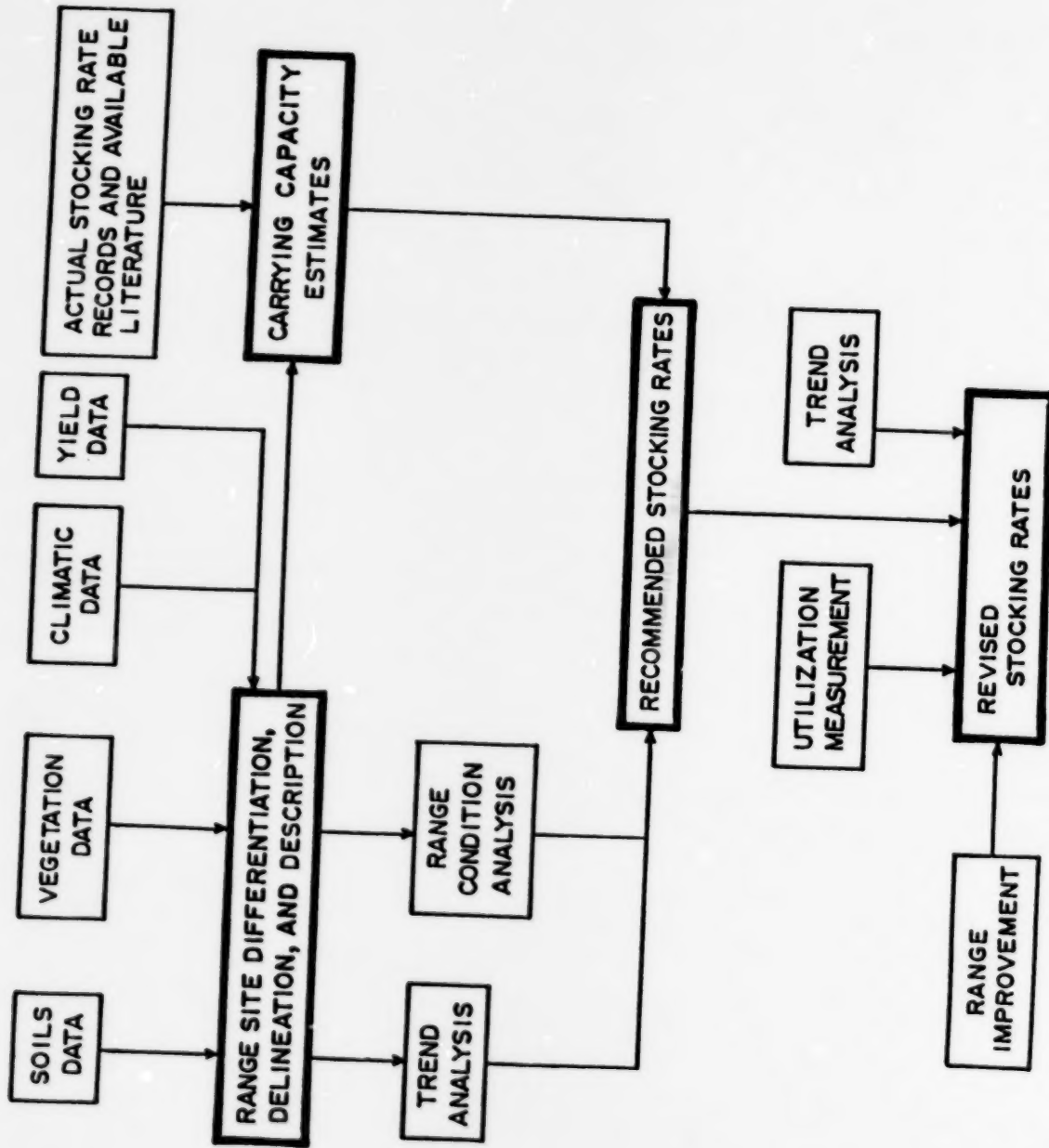


Figure 1. A Framework for Rangeland Assessment

Table 1. Grazing Capacity of Selected Saskatchewan Locations Based on the Guide Developed in the Present Study.

LOCATION	SOIL ZONE	SOIL UNIT	RANGE SITE	VEGETATION	AUM/ acre	AUM/ quart.
NE1-43-2-W3	Black	Ds	Dune sand	Aspen	0.20	32
SW20-45-2-W3	Black	Ds	Dune sand	Aspen	0.20	32
NW4-5-12-W2	Dark Brown	Er	Thin	Grassland	0.25	40
SE13-2-5-W2	Dark Brown	W:L(s)	Loamy (Sands)	Grassland	0.40	64
SE2-3-28-W3	Brown (dry)	Ec:CL	Burnout	Grassland	0.15	24
NW11-3-28-W3	Brown (dry)	Ec:CL	Burnout	Grassland	0.15	24
NE5-5-13-W3	Brown (dry)	Wm:L	Loamy	Grassland	0.25	40
NE6-15-29-W2	Brown (moist)	Hr:L	Loamy	Grassland	0.35	56
NE7-19-8-W3	Brown (moist)	Hr:L	Loamy	Grassland	0.35	56
SE1-5-22-W2	Brown (moist)	Hr:L	Loamy	Grassland	0.35	56
NW5-4-8-W3	Brown (moist)	Hr:LL, Wm:LL	Sandy	Grassland	0.30	48
NW35-14-24-W3	Brown (moist)	Ds	Dune sand	Grassland	0.20	32
SW29-25-27-W3	Brown (dry)	Er	Thin	Grassland	0.15	24
NE29-51-2-W3	Dark Gray	Wh:L	Loamy	Aspen	0.26	42
NW29-51-2-W3	Dark Gray	Er	Thin	Aspen	0.15	24
SE8-3-8-W3	Brown (moist)	Dp	Thin	Grassland	0.20	32
NE31-1-8-W3	Brown (moist)	Dp	Thin	Grassland	0.20	32
NE4-7-26-W3	Brown (moist)	Dp	Thin	Grassland	0.20	32
NW27-32-19-W2	Dark Brown	Alk	Saline upland	Grassland	0.25	40
NW14-60-23-W3	Gray	Ln:LL	Sandy	Aspen	0.26	42
NE18-1-22-W3	Brown (dry)	Av	Normal upland	Grassland	0.25	40
NW14-7-7-W3	Brown (moist)	Ht:FL	Sandy	Grassland	0.30	48
SE2-42-24-W3	Dark Brown	Lake	Saline upland	Grassland	0.25	40
SW6-21-13-W3	Brown (dry)	Sc:HVC	Clayey	Grassland	0.25	40

3.1 Soil Zone and Soil Associations

Using soil maps, determine the soil mapping unit(s) found in the range unit or lease of concern. Use the most recent and detailed soil map available. The following are some examples of soil mapping units:

- (1) Hatton loamy sand
- (2) Haverhill loam
- (3) Echo clay loam
- (3) Dune sand
- (4) Alkaline
- (5) Hillwash
- (6) Eroded
- (7) Dissected plateau

Additional examples are shown in Table 1.

Also, note the soil zone as indicated on the soil map. The Brown Soil zone has been divided into: dry subzone with annual precipitation lower than 13" (325 mm), and moist subzone with precipitation greater than 13" (325 mm) (Figure 2). This arbitrary subdivision will not be needed when coverage of detailed soil surveys is completed.

The use of a range map would greatly facilitate the assessment process and will help in implementing grazing management measures. Air photo maps are often used as base maps. At this stage it would be useful to gather information on topography of the area from soil maps or topographic maps.

The source of soils information is given in the references section. Additional information may be obtained from your nearest soils and crop specialist.

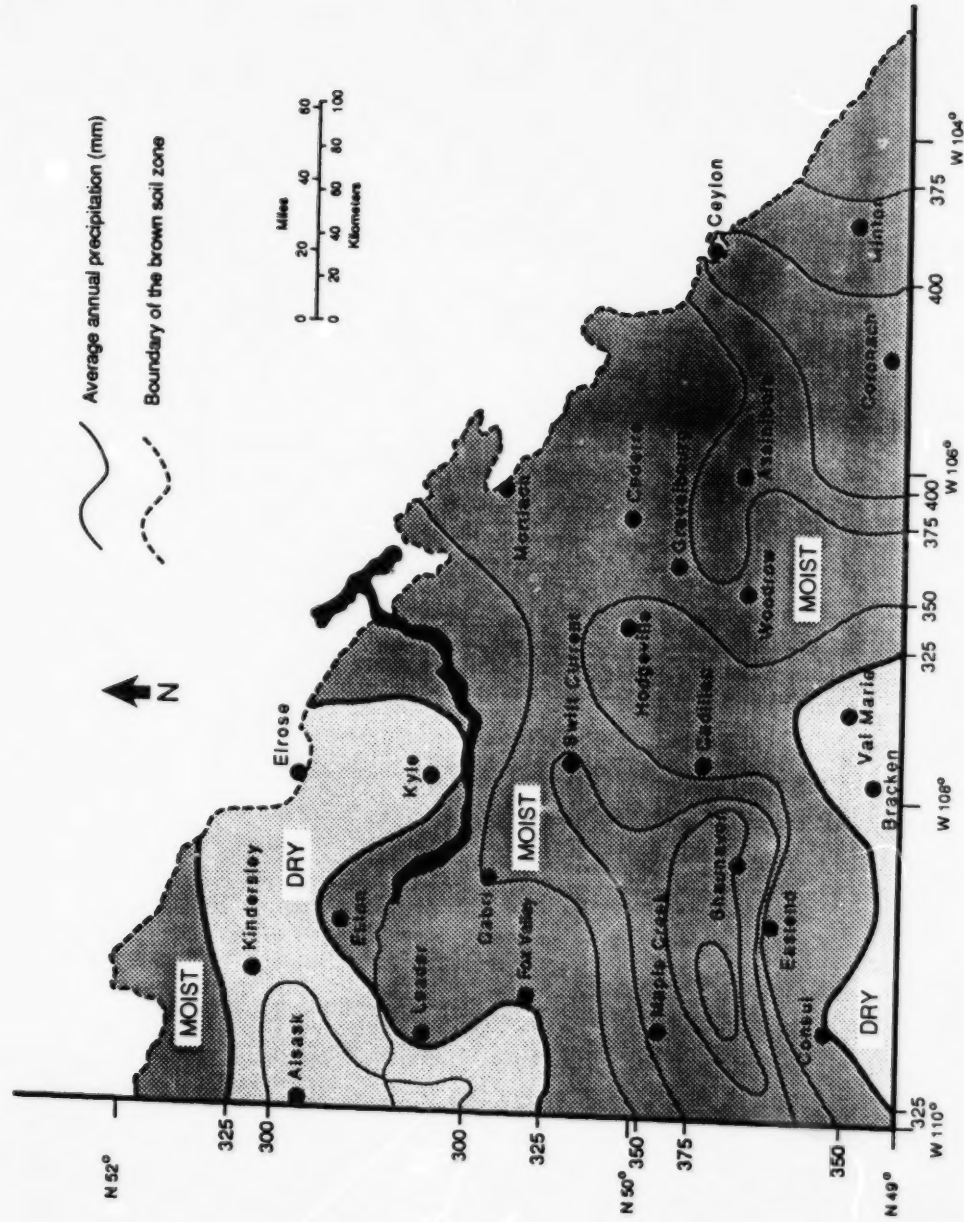


Figure 2. Soil moisture regime in the brown soil zone as interpreted from the annual precipitation normals.

3.2 Range Sites

Different kinds of rangeland are called range sites. These are ecological subdivisions into which rangeland is divided for the purpose of study, evaluation, and management. Range sites are, in effect, rangeland capability classes. Therefore, their identification is an essential prerequisite for range assessment and analysis.

Range sites may be identified using the soils information obtained above. A guide for identification of range sites from soils information is given in Appendix A.1. Range sites within a range unit or lease should be mapped and their areal extent calculated.

In a few cases, soils information is insufficient for direct identification of range sites. In such cases, additional information such as topography and drainage characteristics are needed. Methods to overcome this problem are described in Appendix A.2.

Range sites can also be determined using the range site descriptions given in Appendix B.

3.3 Vegetation Type

Identify and map the main vegetation types on the range. Use recent air photos or your field experience in the process. The main vegetation types encountered are: native grassland, wetland, aspen woodland, cultivated pasture and hay fields. On air photos, seeded pastures and hay fields exhibit smoother and more uniform texture and lighter tone than native grassland and shrub or tree-dominated areas.

Native grassland has a smoother texture and lighter tone than shrub-dominated and wooded range types. Notes on tree density could also be obtained from air photos or field experience.

Mapping of vegetation types may be done on overlays to be superimposed on the basic range map. The areal extent of each vegetation type within the range unit can then be determined from the vegetation type overlay.

3.4 Grazing Capacity

In the previous steps, you have determined the soil zone or subzone and identified the main range sites and vegetation types. Using that information, grazing capacity value can then be estimated from the grazing capacity guide (Table 2). The guide provides grazing capacity estimates by range site within each soil zone or subzone. Where appropriate, the type of vegetation is specified. Nonvegetated areas, such as active dunes and certain dry lake bottoms, are excluded from grazing capacity calculations.

In this guide, grazing capacity estimates are expressed as animal unit months (AUM) per acre. An animal unit month is based on forage requirements for a 1000 lb mature cow for one month. This is estimated to average 780 lb of dry forage.

The grazing capacity estimates given here are based on a continuous or season-long grazing practice which is the most

Table 2. Guide to Grazing Capacity (AUM/acre) of Saskatchewan Rangeland

SITE	SOIL ZONE							
	Brown Dry*	Brown Moist*	Dark Brown Grassland	Dark Brown Aspen	Black Grassland	Black Aspen	Gray Aspen	Gray Nonwooded**
Clayey	0.25	0.35	0.45	0.12	0.55	0.20	0.26	0.40
Loamy	0.25	0.35	0.45	0.12	0.55	0.20	0.26	0.40
Sandy	0.20	0.30	0.40	0.12	0.45	0.20	0.26	0.40
Sands	0.20	0.30	0.40	0.12	0.45	0.20	0.26	0.40
Dune sand	0.15	0.20	0.30	0.12	0.30	0.20	0.26	0.40
Burnout	0.15	0.20	0.25	-	0.30	-	-	-
Saline upland	0.15	0.20	0.25	-	0.30	-	-	-
Closed depression	0.40	0.50	0.60	0.20	0.70	0.25	0.30	0.40
Thin	0.15	0.20	0.25	-	0.30	0.10	0.15	0.20
Badland	0.08	0.10	0.20	-	-	-	-	-
Gravelly	0.15	0.20	0.25	-	0.30	-	-	-
Shallow-to-gravel	0.15	0.20	0.25	-	0.30	-	-	-
Limy	0.15	0.20	0.25	-	0.30	-	-	-
Saline lowland	0.25	0.35	0.45	-	0.55	-	-	-
Wetland	0.60	0.70	0.80	-	0.90	-	-	0.40

* Dry: annual precipitation <13"

Moist: annual precipitation >13"

** Nonwooded includes natural openings as well as cleared (nonseeded) and burned areas.

common practice in Saskatchewan at present time. The effect of other grazing practices is taken into consideration when setting stocking rates (Section 5).

3.5 Total Number of Animal Units

Given the areal extent and the grazing capacity for each range site, the number of animal units (AUMs) can now be calculated for that site: area in acres x grazing capacity in AUM/acre. If more than one range site or vegetation type is present, calculate the AUMs for each site or vegetation type as explained above. The summation of these values gives the total AUMs for the whole unit or lease.

3.6 Animal Numbers

The total number of animal months can now be calculated from the total number of animal unit months. This will depend on the kind, class and size of grazing animals. You will need to use Table 3 which gives the animal unit equivalents for the common grazing animals in Saskatchewan. For example, a ewe is equivalent to 0.2 animal units. If necessary adjust for cow size using Figure 3.

4 OTHER CONSIDERATIONS

While grazing capacity estimates are sufficient as an index for assessing land value or rental fees, further information is needed for developing a rangeland management plan. The process of rangeland planning is described in

Table 3. Animal Equivalent Guide

KIND/CLASS OF ANIMALS	ANIMAL UNIT EQUIVALENT
Cattle, mature cow *	1.00
Cattle, mature cow, with a calf *	1.00
Cattle, weaned calf	0.55
Cattle, yearling	0.75
Cattle, bull	1.55
Horse, at least 3 years old	1.50
Horse, 2-year old	1.00
Horse, yearling	0.75
Sheep, ewe	0.20
Sheep, ram	0.26
Sheep, one year or younger	0.15
Deer	0.20
Antelope	0.10
Bison	1.25
Elk	0.85

* This is based on a 1000 lb animal. Adjustment must be made for heavier animals. Use Figure 3 for this purpose.

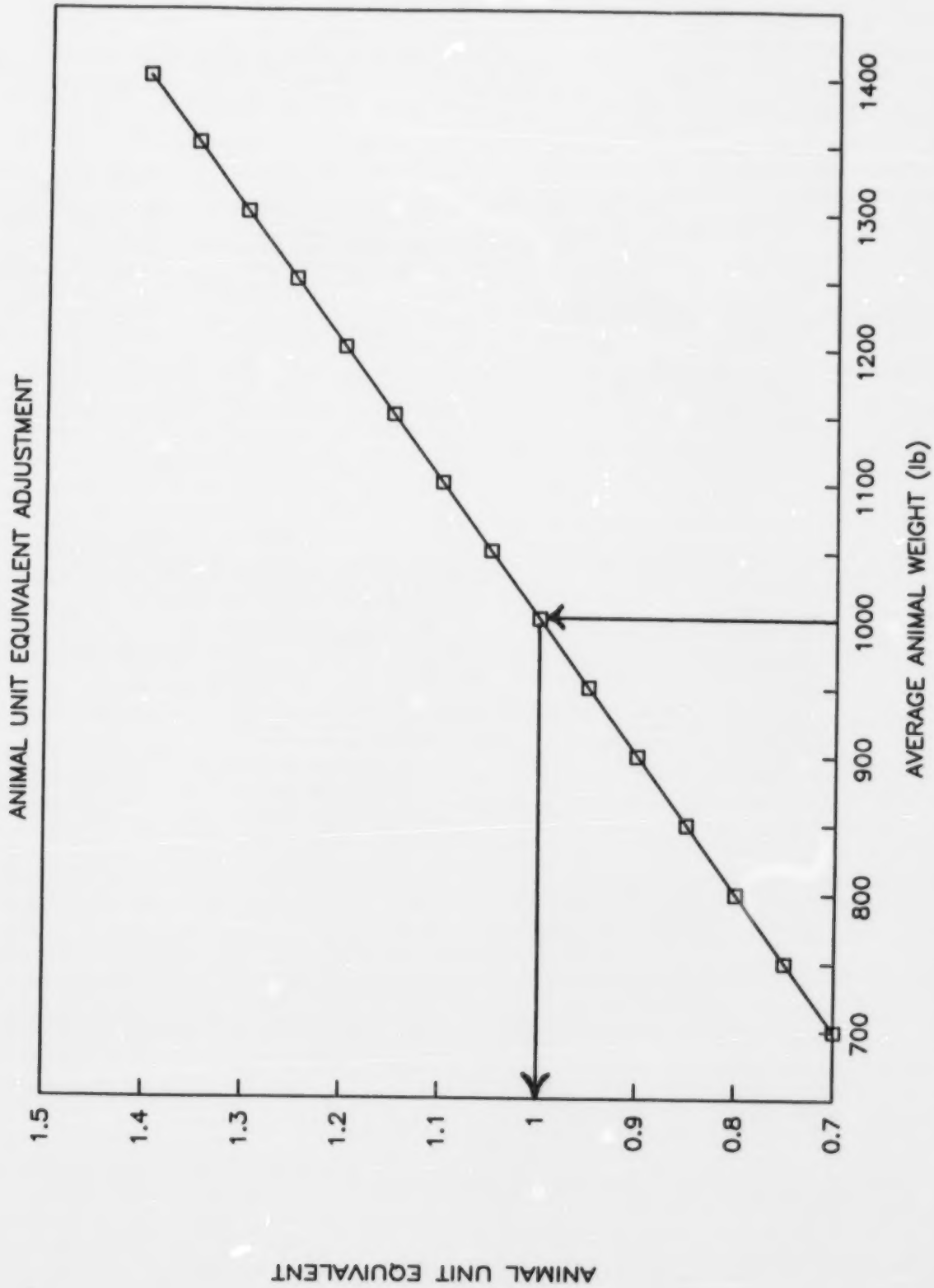


Figure 3. Guide for Adjusting for Cattle Size in Calculating Stocking Rates
(follow arrow as shown in the example)

Abouguendia (1990). We restrict our treatment here to rangeland assessment aspects, such as stocking rates, range condition and range monitoring (see Section 2 and Figure 1).

The most difficult problem facing the range manager during rangeland planning is setting the appropriate stocking rates. The following section address this particular problem.

5 STOCKING RATES

Selection of the proper stocking rate is the most critical step in planning for grazing management. It affects forage production, forage quality, animal performance, the health of the range and the financial returns from the ranch operation.

Proper stocking when employed together with the other grazing management principles would:

- (1) ensure uniform use over all the range.
- (2) provide a residual or unused growth (carryover) that has a considerable value in regaining plant vigour, in protecting the soil, in protecting the plant in severe winters, in restoring soil fertility, in trapping snow, and in providing an emergency feed.
- (3) Improve animal conditions which could result in greater calving or lambing and in higher prices.
- (4) Reduce animal losses.

5.1 Setting Stocking Rates

Proper stocking rates depend on many factors including:

- (1) Climatic characteristics
- (2) Range site quality
- (3) Range condition
- (4) Type of vegetation
- (5) Topography
- (6) Grazing management practices
- (7) Recent and current weather conditions.

Because of the variations caused by the above factors, an initial stocking rate is determined on the basis of the best available information and then it is revised as experience is gained with the particular range in question. Furthermore, year-to-year adjustments may be necessary depending on current season's growing conditions.

Unfortunately, there is no standardized method for determining proper stocking rates. Usually, initial stocking rates are determined on the basis of one or more of the following approaches:

- (1) Available guides and published stocking rates.
- (2) Experience of other ranches with similar range sites.
- (3) An estimate of the average annual forage yield from clipping data.
- (4) An estimate of the average annual forage yield calculated from the average annual precipitation.

One of the common methods employed in determining initial stocking rate for a specific range is based on yield information. In this method forage is clipped at a height of about one inch above the soil surface within a defined area, say 1 m x 1 m. Only current year's growth is clipped. Dead material from previous years should be removed. You may need to repeat this in several areas to obtain a representative sample of the field or range site. Also, you need to repeat sampling for several years to account for interseasonal variability. The material should be air-dried and then weighed. An average yield is calculated and converted into pounds per acre. The average yield is then multiplied by a proper use factor (generally accepted as 55% for most native rangeland) to obtain usable forage. For example, if average yield is 600 lb/acre, usable forage will be 330 lb/acre (600×0.55). Stocking rate in animal unit month (AUM) per acre can then be calculated (available forage/780, or $330/780 = 0.42$ AUM/acre). This assumes 780 lb as the amount of air-dry forage required by a 1000 lb cow for a month.

5.2 Using Stocking Rate Guide

To determine stocking rate using the guide (Appendix C) developed in this study, follow the steps described below:

- (1) Determine range site and vegetation type as explained in Section 3.
- (2) Determine range condition as explained in the next section.

(3) Find the recommended initial stocking rate for the range site and range condition class from the appropriate stocking rate table (Appendix C).

(4) Total number of animal units (AUMs) for a particular field or site can then be calculated: $\text{area in acres} \times \text{initial stocking rate (AUM/acre)}$ (Table 4).

(5) Apply appropriate utilization cuts if necessary due to such factors as slope (Table 5) or distance to water (Table 6). The remaining AUMs are considered available for grazing.

(6) To convert the AUMs (step 5) to animal months, use the animal unit equivalent guide provided earlier (Table 3). As indicated earlier, adjust for cow size using Figure 3.

If more than one range site or vegetation type is present, determine the areal extent of each using soil and photo maps. Calculate the AUMs for each range condition class in each range site as explained above. The summation of these values gives the total AUMs for the field or ranching unit.

It should be emphasized again that the recommended stocking rates indicated in this publication assume continuous or season-long grazing. Higher stocking rates are possible when adopting specialized grazing systems or grazing during the dormant season. The potential increase in grazing capacity would vary depending on range condition, the grazing system used, range site, and current grazing management practices.

Table 4. Calculation of Initial Stocking Rates (Dark Brown Soil).

Section	Site	Condition	Acres	Recommended Stocking Rates AUM/acre	AUM
4	Clayey	Poor	640	0.23	147
5	Clayey	Poor	590	0.23	136
	Loamy	Fair	50	0.29	15
6	Clayey	Poor	30	0.23	6
	Loamy	Fair	400	0.29	116
7	Loamy	Excellent	640	0.45	288
8	Clayey	Fair	280	0.29	81
	Loamy	Good	360	0.36	130
9	Clayey	Poor	610	0.23	140
	Loamy	Fair	30	0.29	9
16	Clayey	Fair	50	0.29	15
	Loamy	Good	590	0.36	212
17	Loamy	Excellent	640	0.45	288
18	Loamy	Excellent	640	0.45	288
Crested Wheatgrass			200	0.65	130
Total					2001
AU/5 month season					400

Table 5. Suggested Utilization Cuts Due to Degree of Slope.*

% SLOPE	% Reduction in Stocking (cuts)
0-10	None
11-30	30
31-60	60
Over 60	100

* The values indicated are used extensively in various range populations. One of the original studies that led to these values is that of Mueggler (1965) in Montana.

**Table 6. Suggested Utilization Cuts Due to
Distance from Water.***

DISTANCE		% Reduction in Stocking
Miles	Kilometers	(cuts)
0-1	0-1.6	None
1-2	1.6-3.2	50
>2	>3.2	100

* The values indicated are widely used in various range publications (see, for example, Holechek 1988).

6 RANGE CONDITION

6.1 General

The concept of range condition discussed here is based on the response of different range plants to continued heavy grazing. The plant species of rangeland may be grouped into the following main categories on the basis of their response to grazing (Figure 4):

(1) Decreasers: these are plants that decrease in importance as a result of continued heavy grazing.

(2) Increasers: these are plants that increase in importance when subjected to continued heavy grazing pressures. Usually increasers start declining after a certain period of time. Some increasers, such as fringed sage, continue to increase with heavy grazing.

(3) Invaders: these are plants that are not considered as part of the natural vegetation cover, but appear and increase as heavy grazing weakens the native plants.

The range condition classification places the range on a scale between two reference points varying in the proportion of the different plant groups. The highest point is often represented by the "climax" for the specific range site (left side of Figure 4). This highest point is characterized largely by the dominance of decreaseers but may contain a certain amount of increasers. It is assumed that such condition provides the highest productivity and greatest ecological stability and is in balance with the prevailing

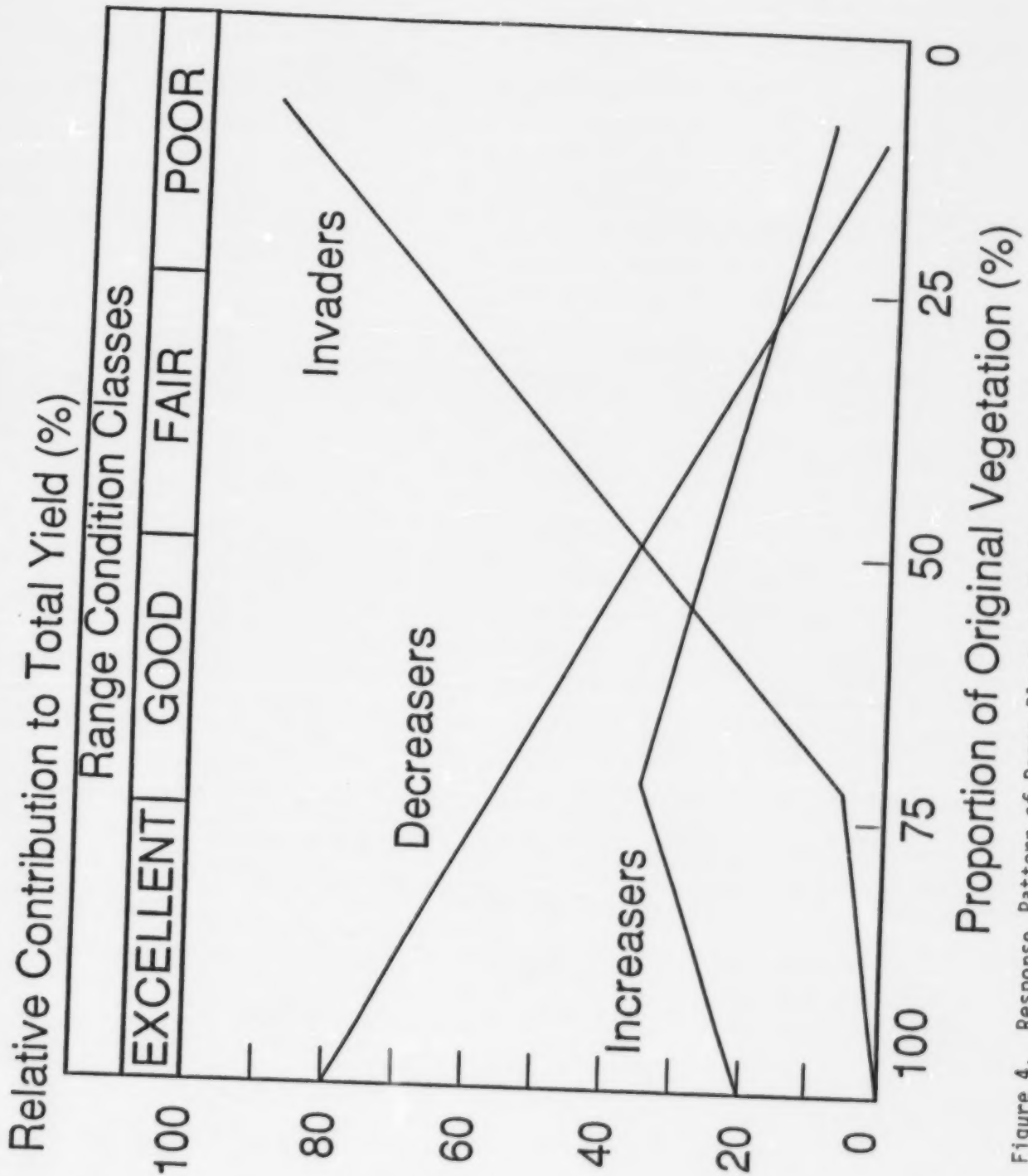


Figure 4. Response Pattern of Range Plants to Prolonged Heavy Grazing.

environmental conditions. The other extreme point is represented by a denuded (degraded) range area (right side of Figure 4). The latter case describes an area that has lost almost all its original vegetation and with vegetation cover that has been reduced substantially. Such area is usually characterized by "weedy" vegetation or invaders.

The range condition gradient described above is arbitrarily divided into four classes:

- (1) excellent range condition with original vegetation contributing more than 75% of the total yield;
- (2) good range condition with original vegetation contributing between 50% and 75% of the total yield;
- (3) fair range condition with original vegetation contributing between 25% and 50% of the total yield; and
- (4) poor range condition with original vegetation contributing less than 25% of the total yield.

The change in range condition described above has important implications with respect to the management of the range. Such change is usually accompanied by a substantial reduction in the quantity (Figure 5) and quality of forage produced. Decreasers are the most valuable species because they yield the most forage in relation to the area of soil they occupy. Increasers are lower growing and often less palatable species. Furthermore, the increaser and invader categories include some poisonous plants. Therefore, a reduction in range condition necessitates a reduction in

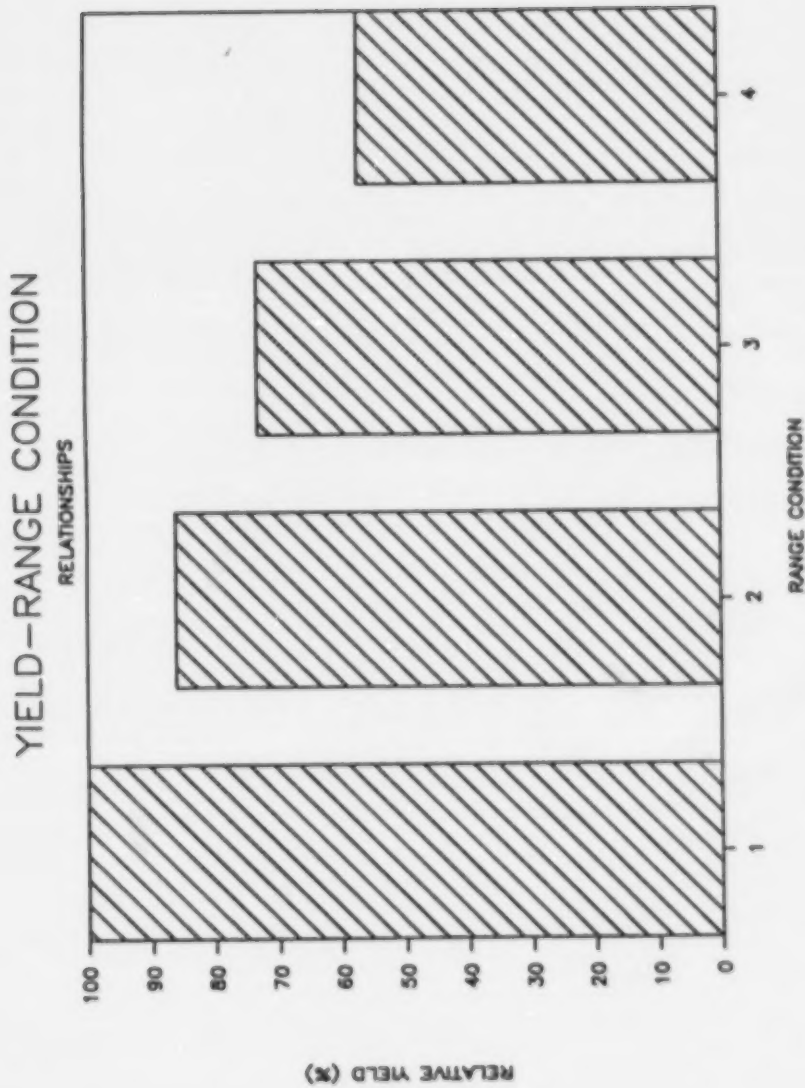


Figure 5. Reduction in Forage Yield with Decline in Range Condition (because this graph is based on data for different sites, the actual reduction is likely greater in magnitude)

Range Condition Classes: 1. Excellent
2. Good
3. Fair
4. Poor

stocking rates, or application of other grazing management measures, in order to balance forage production and provide for range recovery or improvement.

Application of the range condition classification in determining appropriate stocking rates has resulted in substantial range improvement over many millions of acres of rangeland in the United States and elsewhere.

The main Saskatchewan range plants have been classified according to their response to grazing on the basis of available literature and the experience of the authors (Appendix D).

6.2 Range Condition Evaluation

One of the common methods used in determining range condition is based on species composition by weight. Composition by weight means the proportions of the different species present on a weight basis. Because actual weight is a laborious technique, weight estimate is often used. For beginners a combination of actual weight and estimated weight is desirable.

Initial range condition surveys should be carried out for each range site within each field. Future surveys may be restricted to key areas (or indicator areas) in each range unit or field. A key area should meet the following criteria:

- (1) accessible to livestock grazing;
- (2) provide a significant amount of forage; and
- (3) located away (e.g., 200 m) from such features as watering points and fences.

The range condition classification described here is applicable mainly to grasslands. In certain regions, such as the Gray Soil Zone, the climax plant community is aspen woodland which is not the most suitable community for grazing. Early successional species are more productive. However, plant indicators, for example decreasers, are still useful in assessing grazing pressures in such communities (Appendix D).

Although the technique described here is the best available for the Saskatchewan at present time, it is generally agreed that it requires improvement through acquiring more field data. Also, development of new techniques should be considered.

6.3 Steps in Determining Range Condition

- (1) Prepare a rough sketch of the field to be surveyed.
- (2) Determine soil zone and mean annual precipitation.
- (3) Determine and map the major range sites. Sites may be combined depending on their areal extent and their pattern of occurrence.
- (4) Map the main range vegetation types such as native grassland, shrubland, bush, woodland, and seeded pasture.

(5) Select the key area(s). For initial surveys, a thorough coverage may be necessary. Subsequent surveys could be restricted to key areas.

(6) Using a small sampling frame, for example 0.5 m x 0.5 m, estimate the percentage contributed by each of the main species (species composition) to the total yield within that frame*. The form shown in Appendix E can be used for recording the information and subsequent calculations.

(7) Calculate range condition rating and determine range condition class according to the following scale:

- | | |
|---------------|---------|
| (a) Excellent | 76-100% |
| (b) Good | 51-75% |
| (c) Fair | 26-50% |
| (d) Poor | <26% |

* For managers doing range evaluation for the first time, it is desirable to first harvest several frames to estimate species composition by actual weight (use air-dry weights). Prior to harvest, make an estimate of the species composition in the same frames. Then, use the actual weight information to calibrate your weight estimates.

To arrive at a range condition rating, the proportions contributed by the decreasers are totalled and included in the calculation of range condition. The values for the invaders, on the other hand, are excluded completely from the calculations. In the case of the increasers, only the maximum climax proportions are included. The maximum climax proportions for the various range sites in the different soil zones are given in Appendix F. Tables 7 and 8 show examples of range condition calculations.

Table 7. Range Condition Calculations: Example I.

Soil Zone: Brown (Hatton sandy loam)
Site: Sandy

PLANT SPECIES	ACTUAL COMPOSITION BY WEIGHT (%)	CLIMAX OR DESIRABLE PLANTS (%)
Needle-and-thread	15	15
Blue grama	35	10
Western wheatgrass	5	5
June grass	10	5
Upland sedges	5	5
Fringed sage	30	5
	-----	-----
	100	45
Range Condition Class		Fair

Table 8. Range Condition Calculations: Example II.

Soil Zone: Black (Oxbow loam)Site: Loamy

PLANT SPECIES	ACTUAL COMPOSITION BY WEIGHT (%)	CLIMAX OR DESIRABLE PLANTS (%)
Rough fescue	30	30
Western porcupine grass	5	5
Western wheatgrass	5	5
Green needlegrass	5	5
Weedy forbs	10	5
Shrubby cinquefoil	15	0
Western snowberry	20	5
Sedges	10	5
	-----	-----
	100	60
Range Condition Class		Good

7 RANGELAND MONITORING

The primary goal of rangeland monitoring is to ensure maintenance or improvement of the range. Monitoring data enable an assessment of the response to management and improvement actions and give an indication of the type of adjustments needed. A comprehensive monitoring program should include the following two components.

- (1) Trend in range condition; and
- (2) Forage utilization.

In addition to the usual book-keeping practices, maintaining records of range management information should be an essential part of any range operation. Management information should cover such aspects as: rangeland inventory and evaluation, stocking rates, improvement practices, grazing management and animal performance. Such records will maximize the benefits from rangeland monitoring.

7.1 Trend in Range Condition

Determining range site and condition is an essential first step in proper range evaluation. However, we need another measure to tell us what is happening to the range with time after this initial assessment and after implementing the various rangeland management and improvement measures. This is called trend analysis, or rangeland monitoring. The purpose of range trend analysis is to detect the direction of change in the condition of vegetation and soil. Therefore, it provides an assessment of the

appropriateness of the current management practices and thus help in determining whether any changes in management are necessary. It should be remembered, however, that prolonged drought periods could induce a downward trend in the condition of the range. This should be kept in mind when interpreting the results of monitoring. Data from an exclosure will facilitate interpretation of the results.

Two main approaches are used in trend analysis:

(1) apparent trend which is based on an assessment, at one point in time, of a number of parameters that reflect apparent changes in range condition; and

(2) measured trend, requiring resurveying of a defined location over a number of years.

In order to reduce the cost of trend analysis, the surveyors may focus on key species or indicator species. Key species are the most important species on the range. Usually two to four species are used. The key species are used as indicators because they usually furnish the bulk of the foliage. It is often recommended that a key species should contribute at least 20% of available forage. This concept is also used in connection with utilization estimates.

Factors that are commonly used to evaluate apparent trend in vegetation condition are:

- (1) Reproduction of desirable plant species
- (2) Reproduction of undesirable plant species
- (3) Browse condition
- (4) Vigor of key species

Factors that are commonly used to evaluate apparent trend in soil condition include:

- (1) Amount of litter
- (2) Signs of accelerated erosion
- (3) Rodent activities

One of the most important parameters used to determine (or measure) trend is basal vegetation cover by species. This is usually done by measuring basal cover intercept along permanently established transects. Also, point frame or point step methods may be used to measure trend. In the last two cases the surveyor looks at a specific number of points that are randomly located. The number of points that hit plants near their base are related to the total number of points to obtain cover. Litter cover and bare ground can also be estimated from the same survey. Contact your rangeland specialist for more information about rangeland monitoring.

7.2 Range Forage Utilization Measurement

Range utilization is the degree to which animals have consumed the total current production of a range area. It is expressed in percentage by weight. Utilization measurement is not a goal in itself. Rather, it is a tool employed to ensure maintenance or improvement of range and livestock productivity. Utilization measurements provide the basis for grazing pressure adjustments during the grazing season.

Although there are many methods devised to measure utilization, there are not sufficient data to adapt most of them for use in Saskatchewan rangeland. The weight comparison method, though laborious, is the most accurate. In this method, the weight of grazed plants in key areas is compared with that of ungrazed plants. Movable cages are used to protect plants from grazing. The weight estimate method is also used but requires initial training.

8 LITERATURE CITED

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APPENDIX A.1
GUIDE TO RANGE SITES

Appendix A.1. Guide to Range Sites

SOIL ZONE SOIL	TAXONOMIC UNITS	TEXTURE RANGE SITE
Brown	ALKALI	Variable
Brown	ALKALI	Variable
Brown	ALLUVIUM	Variable
Brown	ALLUVIUM	Variable
Brown	ANTELOPE HUMIC REGOSOL	S, LS, FL
Brown	ANTELOPE HUMIC REGOSOL	LS
Brown	ANTELOPE ORTHIC REGOSOL	S, LS
Brown	ANTELOPE ORTHIC REGOSOL	S
Brown	ARDILL CALCAREOUS BROWN	L
Brown	ARDILL ELUVIATED BROWN	CL, L
Brown	ARDILL GLEYED BROWN	L
Brown	ARDILL ORTHIC BROWN	L
Brown	ARDILL ORTHIC BROWN	CL, L
Brown	ARDILL REGO BROWN	CL, L
Brown	ARDILL SOLOMETZIC BROWN	CL, L
Brown	ARDILL SOLOMETZIC BROWN	C
Brown	BIG MUDDY SOILS	C, CL
Brown	BIG MUDDY SOILS	C, CL
Brown	BIRSAY ORTHIC BROWN	FL, SL
Brown	BIRSAY ORTHIC BROWN SALINE PHASE	VL
Brown	BIRSAY SOLOMETZIC BROWN	SL
Brown	DISSECTED PLATEAU	Variable
Brown	DISSECTED PLATEAU	Variable
Brown	DISSECTED PLATEAU	Variable
Brown	DUNE SAND	S
Brown	DUNE SAND	S
Brown	EASTEND SOILS	L, CL
Brown	EASTEND SOILS	SIC
Brown	ECHO BROWN SOLOD	CL, L
Brown	ECHO BROWN SOLODIZED SOLONETZ	CL, L
Brown	ECHO BROWN SOLONETZ	CL, L
Brown	ERODED	Variable
Brown	EXPOSURE	Variable
Brown	FIFE LAKE	L, CL
Brown	FOX VALLEY GLEYSOL	SIL
Brown	FOX VALLEY ORTHIC BROWN	L
Brown	FOX VALLEY ORTHIC BROWN SALINE PHASE	L
Brown	FOX VALLEY REGO BROWN	L
Brown	FOX VALLEY SOLOMETZIC BROWN	L, SIL
Brown	GRAVEL	
Brown	HATTON CALCAREOUS BROWN	SL
Brown	HATTON GLEYED BROWN	LS
Brown	HATTON GLEYED BROWN	FL
Brown	HATTON GLEYED CALCAREOUS BROWN	SL
Brown	HATTON ORTHIC BROWN	LS
Brown	HATTON ORTHIC BROWN	L
Brown	HATTON ORTHIC BROWN	SL, FL, FSL
Brown	HATTON REGO BROWN	SL
Brown	HAVERHILL CALCAREOUS BROWN	L
Brown	HAVERHILL CALCAREOUS BROWN	SL
Brown	HAVERHILL ELUVIATED BROWN	L
Brown	HAVERHILL ORTHIC BROWN	SL, FL
Brown	HAVERHILL ORTHIC BROWN	L
Brown	HAVERHILL REGO BROWN	L, SCL
Brown	HAVERHILL REGO BROWN	SL
Brown	HAVERHILL SOLONETZIC BROWN	L
Brown	HILLWASH	Variable
Brown	KELSTERN BROWN GLEYED SOLOD	L
Brown	KELSTERN BROWN SOLOD	CL, L, SIL
Brown	KELSTERN BROWN SOLODIZED SOLONETZ	L
Brown	KELSTERN BROWN SOLONETZ	CL, L, SIL
Brown	KETTLEHUT BROWN GLEYED SOLODIZED SOLONETZ	C
Brown	KETTLEHUT BROWN SOLOD	CL, L, SIL
Brown	KETTLEHUT BROWN SOLODIZED SOLONETZ	C, CL, L, SIL
Brown	KETTLEHUT BROWN SOLONETZ	CL, L, SIL
Brown	KETTLEHUT GLEYED BROWN SOLONETZ	C
Brown	KINDERSLEY BROWN GLEYED SOLODIZED SOLONETZ	CL
Brown	KINDERSLEY BROWN SOLOD	C
Brown	KINDERSLEY BROWN SOLODIZED SOLONETZ	C, CL, L
Brown	KINDERSLEY BROWN SOLONETZ	C
Brown	MEADOW	Variable
Brown	ROBSART BROWN SOLODIZED SOLONETZ	L
Brown	ROBSART GLEYED BROWN SOLODIZED SOLONETZ	CL
Brown	RUNWAY	Variable
Brown	SALINE	Variable
Brown	SALINE	Variable
Brown	SAND	S
Brown	SCEPTRE	C
Brown	SCEPTRE	HC
Brown	SWINTON ORTHIC BROWN SALINE PHASE	L
Brown	VALOR ELUVIATED BROWN	L
Brown	VALOR GLEYED BROWN	SICL, SIL
Brown	VALOR GLEYED CALCAREOUS BROWN	SIL
Brown	VALOR GLEYED REGO BROWN	SICL
Brown	VALOR ORTHIC BROWN	CL, L, SIL
Brown	VALOR REGO BROWN	CL
Brown	VALOR SOLONETZIC BROWN	
Brown	WILLOWS CALCAREOUS BROWN	CL
Brown	WILLOWS GLEYED BROWN	L
Brown	WILLOWS ORTHIC BROWN	C
Brown	WILLOWS ORTHIC BROWN	CL, L
Brown	WILLOWS ORTHIC BROWN SALINE PHASE	SIL
		saline upland (no ponding)
		saline lowland (ponding)
		normal upland (no ponding)
		wetland (ponding)
		thin
		dune sand
		thin
		dune sand
		loamy
		loamy
		closed depression
		loamy
		loamy
		loamy
		loamy
		clayey
		saline lowland
		wetland
		sandy
		saline upland
		sandy
		thin (strongly to very strongly sloping)
		normal upland (gently to moderately sloping)
		badland
		dune sand (strongly to very strongly rolling)
		sands (gently to moderately rolling)
		loamy
		clayey
		burnout
		burnout
		burnout
		thin
		badland
		loamy
		wetland
		loamy
		saline upland
		loamy
		loamy
		gravelly
		sandy
		sands
		sandy
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Appendix A.1. Guide to Range Sites continued..

SOIL	ZONE	TAXONOMIC UNITS	TEXTURE	RANGE SITE
Brown	WILLOWS REGO BROWN	CL	loamy	
Brown	WILLOWS SOLOMETZIC BROWN	CL	burnout	
Brown	WINGELLO BROWN SOLODIZED SOLOMETZ	L	burnout	
Brown	WOOD MOUNTAIN	L, CL	loamy	
Brown	WOOD MOUNTAIN	FSL, LL, SCL	sandy	
Brown	WOOD MOUNTAIN	C	clayey	
Dark Brown	ALKALI	Variable	saline upland (no ponding)	
Dark Brown	ALKALI	Variable	saline lowland (ponding)	
Dark Brown	ALLUVIUM	Variable	normal upland (no ponding)	
Dark Brown	ALLUVIUM	Variable	wetland (ponding)	
Dark Brown	AMULET CALCAREOUS DARK BROWN	CL	loamy	
Dark Brown	AMULET ELUVIATED DARK BROWN	CL, L, SIL	loamy	
Dark Brown	AMULET GLEYED ELUVIATED DARK BROWN	CL	loamy	
Dark Brown	AMULET ORTHIC DARK BROWN	CL, L, SIL	loamy	
Dark Brown	AMULET SOLOMETZIC DARK BROWN	CL, L	loamy	
Dark Brown	ASQUITH CALCAREOUS DARK BROWN	SL	sandy	
Dark Brown	ASQUITH GLEYED DARK BROWN	LS	wetland	
Dark Brown	ASQUITH GLEYED REGO DARK BROWN SALINE PHASE	LS	saline upland	
Dark Brown	ASQUITH ORTHIC DARK BROWN	S, FS, LS	sands	
Dark Brown	ASQUITH ORTHIC DARK BROWN	FSL, SL	sandy	
Dark Brown	ASQUITH REGO DARK BROWN	FSL, SL	sandy	
Dark Brown	BIGGAR ORTHIC DARK BROWN	LS	sands	
Dark Brown	BIGGAR ORTHIC DARK BROWN	L	loamy	
Dark Brown	BIGGAR ORTHIC DARK BROWN	SL, FSL	sandy	
Dark Brown	BIGGAR ORTHIC DARK BROWN	GL	shallow-to-gravel	
Dark Brown	BRADWELL CALCAREOUS DARK BROWN	L	loamy	
Dark Brown	BRADWELL CALCAREOUS DARK BROWN	VL, SL	sandy	
Dark Brown	BRADWELL ELUVIATED DARK BROWN	VL	sandy	
Dark Brown	BRADWELL ORTHIC DARK BROWN	FSL, VL, SL, FL	sandy	
Dark Brown	BRADWELL ORTHIC DARK BROWN	FS, LS	sands	
Dark Brown	BRADWELL ORTHIC DARK BROWN	L	loamy	
Dark Brown	BRADWELL REGO DARK BROWN	VL, FL	sandy	
Dark Brown	BROOKING DARK BROWN SOLO	L, CL	burnout	
Dark Brown	BROOKING DARK BROWN SOLODIZED SOLOMETZ	L, CL	burnout	
Dark Brown	CYPRESS ORTHIC DARK BROWN	SIL, L	loamy	
Dark Brown	DISSECTED PLATEAU	Variable	thin (strongly to very strongly sloping)	
Dark Brown	DISSECTED PLATEAU	Variable	normal upland (genetly to moderately sloping)	
Dark Brown	DUNE SAND	S	sands (gently to moderately rolling)	
Dark Brown	DUNE SAND	S	dune sand (strongly to very strongly rolling)	
Dark Brown	ELSTON CALCAREOUS DARK BROWN	L, SIL	loamy	
Dark Brown	ELSTON ELUVIATED DARK BROWN	CL	loamy	
Dark Brown	ELSTON ORTHIC DARK BROWN	SIL, L, CL, SICL	loamy	
Dark Brown	ELSTON ORTHIC REGOSOL	SICL	thin	
Dark Brown	ELSTON SOLOMETZIC DARK BROWN SALINE PHASE	SIL, SICL	saline upland	
Dark Brown	ERCHES	Variable	thin	
Dark Brown	ESTEVAN DARK BROWN SOLO	CL	burnout	
Dark Brown	ESTEVAN DARK BROWN SOLODIZED SOLOMETZ	CL	burnout	
Dark Brown	ESTEVAN DARK BROWN SOLOMETZ	CL	burnout	
Dark Brown	EXPOSURE	Variable	badland	
Dark Brown	GRAVEL		gravelly	
Dark Brown	HAMLEY DARK BROWN SOLODIZED SOLOMETZ	SICL, L, SIL	burnout	
Dark Brown	HAMLEY DARK BROWN SOLOMETZ	CL, SICL	burnout	
Dark Brown	HAMLEY GLEYED DARK BROWN SOLOMETZ	L	burnout	
Dark Brown	HILLWASH SOILS	Variable	thin	
Dark Brown	JONES CREEK ORTHIC REGOSOL	SL	thin	
Dark Brown	MEDLOW	Variable	closed depression	
Dark Brown	ROSEMAE DARK BROWN SOLODIZED SOLOMETZ	L	burnout	
Dark Brown	RUNWAY	Variable	thin	
Dark Brown	SALINE	Variable	saline lowland (ponding)	
Dark Brown	SALINE	Variable	saline upland (no ponding)	
Dark Brown	SAND	S	sands	
Dark Brown	SCOTSGUARD ORTHIC DARK BROWN	L	loamy	
Dark Brown	SCOTT CALCAREOUS DARK BROWN	L	loamy	
Dark Brown	SCOTT ORTHIC DARK BROWN	L	loamy	
Dark Brown	SCOTT ORTHIC DARK BROWN	VL	sandy	
Dark Brown	SCOTT REGO DARK BROWN	L	loamy	
Dark Brown	SUTHERLAND REGO DARK BROWN SALINE PHASE		saline upland	
Dark Brown	TUXFORD DARK BROWN SOLODIZED SOLOMETZ	CL	burnout	
Dark Brown	TUXFORD DARK BROWN SOLOMETZ	L	burnout	
Dark Brown	VERA GLEYED HUMIC REGOSOL	LS, S, SL	thin	
Dark Brown	VERA ORTHIC HUMIC REGOSOL	LS, S, MS, FS, LFS, SL	thin	
Dark Brown	VERA ORTHIC HUMIC REGOSOL	LS, S	dune sand	
Dark Brown	VERA ORTHIC REGOSOL	S, FS, MS	dune sand	
Dark Brown	VERA ORTHIC REGOSOL	LS, FS, S	thin	
Dark Brown	WEYBURN CALCAREOUS DARK BROWN	SL	sandy	
Dark Brown	WEYBURN CALCAREOUS DARK BROWN	L, CL	loamy	
Dark Brown	WEYBURN CALCAREOUS DARK BROWN	FS	sands	
Dark Brown	WEYBURN ELUVIATED DARK BROWN	L	loamy	
Dark Brown	WEYBURN GLEYED DARK BROWN	L	loamy	
Dark Brown	WEYBURN GLEYED REGO DARK BROWN	L	loamy	
Dark Brown	WEYBURN ORTHIC DARK BROWN	L, CL	loamy	
Dark Brown	WEYBURN ORTHIC DARK BROWN	FS, LS	sands	
Dark Brown	WEYBURN ORTHIC DARK BROWN	SL, VL, FSL, FL	sandy	
Dark Brown	WEYBURN REGO DARK BROWN	L	loamy	
Dark Brown	WEYBURN REGO DARK BROWN	L, SL	sandy	
Dark Brown	WEYBURN REGO DARK BROWN	FS	sands	
Dark Brown	WEYBURN SOLOMETZIC DARK BROWN SALINE	L	saline upland	
Dark Brown	WYMARK ELUVIATED DARK BROWN	SIL	loamy	
Dark Brown	WYMARK ORTHIC DARK BROWN	FL	sandy	
Dark Brown	WYMARK ORTHIC DARK BROWN	SIL	loamy	
Black	ALKALI	Variable	saline lowland (some ponding)	
Black	ALKALI	Variable	saline upland (no ponding)	

Appendix A.1. Guide to Range Sites continued..

SOIL	SOIL	TAXONOMIC UNITS	TEXTURE RANGE SITE
Black	ALLUVIUM	Variable	normal upland (no ponding)
Black	ALLUVIUM	Variable	wetland (some ponding)
Black	BLAINE LAKE CALCAREOUS BLACK	CL	loamy
Black	BLAINE LAKE ORTHIC BLACK	FL, VFL	sandy
Black	BLAINE LAKE ORTHIC BLACK	CL, L	loamy
Black	BLAINE LAKE REGO BLACK	L	loamy
Black	BLAINE LAKE REGO BLACK SALINE PHASE	CL	saline upland
Black	BLAINE LAKE SOLOMETIC BLACK	L	loamy
Black	BOWE CREEK ELUVIATED BLACK	STL	loamy
Black	BOWE CREEK ELUVIATED BLACK	SL	sandy
Black	BOWE CREEK ORTHIC BLACK	L, SIL	loamy
Black	BOWE CREEK ORTHIC BLACK	VL, SL	sandy
Black	BOWE CREEK ORTHIC BLACK	LL	sandy
Black	CUDWORTH	L, SIL	loamy
Black	CUDWORTH	L	loamy
Black	CUTKNIFE ORTHIC BLACK	VL	sandy
Black	CUTKNIFE ORTHIC BLACK	SIL, L	saline upland
Black	CUTKNIFE ORTHIC BLACK SALINE PHASE	FL	sandy
Black	CUTKNIFE REGO BLACK	S	dune sand (strongly to very strongly rolling)
Black	DUNE SAND	S	Sands (gently to moderately rolling)
Black	DUNE SAND	LS	dune sand
Black	EDAM HUMIC REGOSOL	S, LFS	sands
Black	EDAM HUMIC REGOSOL	FS, LS	thin
Black	EDAM ORTHIC HUMIC REGOSOL	S, LS, FS, LFS	sands
Black	EDAM ORTHIC HUMIC REGOSOL	S, FS	dune sand
Black	EDAM ORTHIC HUMIC REGOSOL	S, FS, LS	thin
Black	EDAM ORTHIC REGOSOL	S, FS	dune sand
Black	ERODED	Variable	thin
Black	FAIRWELL ORTHIC BLACK	L, GL, SIL	loamy
Black	FAIRWELL REGO BLACK	SL	sandy
Black	GRAVEL		gravelly
Black	HAMLIN ORTHIC BLACK	SL, FL, VL	sandy
Black	HILLWASH	Variable	thin
Black	MARSH	Variable	wetland
Black	MAYFAIR CALCAREOUS BLACK	FL	sandy
Black	MAYFAIR CALCAREOUS BLACK	CL	loamy
Black	MAYFAIR ORTHIC BLACK	L, CL	loamy
Black	MAYFAIR ORTHIC BLACK	FL, SL	sandy
Black	MAYFAIR REGO BLACK	L	loamy
Black	MEADOW	Variable	close depression
Black	MEOTA ORTHIC BLACK	FLS, SL, VL, FL	sandy
Black	MEOTA ORTHIC BLACK	LFS, LS	sands
Black	MEOTA REGO BLACK	LFS	sands
Black	ONION LAKE BLACK SOLODIZED SOLOMETE	SIL	burnout
Black	OKBOW	LL	sandy
Black	OKBOW	CL, L	loamy
Black	RUNWAY	Variable	thin
Black	SALINE	Variable	saline lowland (ponding)
Black	SALINE	Variable	saline upland (no ponding)
Black	SAND	S	sands
Black	SPEERS BLACK SOLODIZED SOLOMETE	LS	burnout
Black	UNDIFFERENTIATED SANDS	S	sands
Black	WHITESAND ORTHIC BLACK	SL	sandy
Black	WHITESAND ORTHIC BLACK	LS	sands
Black	YORKTON	LL	sandy
Black	YORKTON	L, CL	loamy
Dark Gray	ALLUVIUM	Variable	normal upland (no ponding)
Dark Gray	ALLUVIUM	Variable	wetland (ponding)
Dark Gray	DUNE SAND	S	sands (gently to moderately rolling)
Dark Gray	DUNE SAND	S	dune sand (strongly to very strongly rolling)
Dark Gray	ERODED	Variable	thin
Dark Gray	HILLWASH SOILS	Variable	thin
Dark Gray	KANSACK ORTHIC DARK GRAY	SIL	loamy
Dark Gray	LORENZO ORTHIC DARK GRAY	L	loamy
Dark Gray	MEADOW	Variable	closed depression
Dark Gray	NISBET ORTHIC DARK GRAY	S, FLS	sands
Dark Gray	NISBET REGO DARK GRAY	LS	sands
Dark Gray	SHELLBROOK ORTHIC DARK GRAY	FL	sandy
Dark Gray	UNDIFFERENTIATED SANDS	S	sands
Dark Gray	WHITENWOOD	LL	sandy
Dark Gray	WHITENWOOD	L, CL	loamy
Luvisol	ALLUVIUM	Variable	wetland (ponding)
Luvisol	ALLUVIUM	Variable	normal upland (no ponding)
Luvisol	DUNE SAND	S	dune sand (strongly to very strongly rolling)
Luvisol	DUNE SAND	S	sands (gently to moderately rolling)
Luvisol	ERODED	Variable	thin
Luvisol	HILLWASH	Variable	thin
Luvisol	MEADOW	Variable	closed depression
Luvisol	MEETING LAKE DARK GRAY LUVISOL	L	loamy
Luvisol	PORCUPINE PLAIN ORTHIC GRAY LUVISOL	L	loamy
Luvisol	SWAN PLAIN ORTHIC GRAY LUVISOL	L	loamy
Luvisol	SYLVANIA DARK GRAY LUVISOL	FL	sandy
Luvisol	UNDIFFERENTIATED SANDS	S	sands
Luvisol	WAITVILLE DARK GRAY LUVISOL	L	loamy
Gleysol	CATKIN CHERNOSEMIC SALINE	SL, L	saline upland
Gleysol	CATKIN GLEYSOLIC SALINE	SL	saline upland
Gleysol	FLAT LAKE SALINE SOILS	L, CL, C	saline upland
Gleysol	GLEYSOLIC SOILS	SICL, C, LS, FS, SIL, L, S	wetland
Gleysol	GRILL LAKE SALINE SOILS	C, MC	saline lowland
Gleysol	HUMIC GLEYSOL	L, SIL, CL, SICL	wetland
Gleysol	HUMIC GLEYSOL	CL	saline lowland
Gleysol	HUMIC LUVIC GLEYSOL	CL	wetland

Appendix A.1. Guide to Range Sites continued..

SOIL ZONE SOIL	TAXONOMIC UNITS	TEXTURE RANGE SITE
Gleysol LUVIC GLEYSOL Gleysol OMNITHIC MUVIC GLEYSOL Regosol HILLWASH SOILS Regosol SHALE Regosol See Regosols in the various zones	C CL Variable C	wetland wetland thin badland thin

APPENDIX A.2
NOTES ON THE USE OF THE RANGE SITE GUIDE

In a few cases, incomplete soils information makes site identification difficult. In such cases, additional information such as topography and drainage characteristics are needed. This particular problem is encountered mainly in areas classified as Dissected Plateau, Dune Sand, Sand, and Alluvial soils.

The "Dissected Plateau" soil unit includes areas that can be classified as thin upland and areas that can be classified as normal upland. In this case, topography is the criteria for differentiating between the two sites. Areas with slopes greater than 15% are classified as thin upland with remaining areas as normal upland.

The undifferentiated Sand soil unit encompasses two range sites. Those areas with slopes greater than 15% are classified as dune sand site and the remaining areas as sand site.

The category of Alluvial soils would be classified as normal upland where no water ponding occurs. Otherwise it is classified as wetland. Areas classified as lakebottom are classified in a similar manner.

A detailed description of range sites is given in Appendix B.

APPENDIX B
RANGE SITES

B.1 Range Site Determination

Different kinds of rangeland are called range sites. These are ecological subdivisions into which rangeland is divided for the purpose of study, evaluation, and management. Identification of range sites is an essential prerequisite for range evaluation and analysis. Major range site factors which influence forage production and range management are:

(1) Soil moisture: Available soil moisture depends on such factors as soil depth, texture, organic matter, topography and the amount of precipitation and evaporation characteristic of the region.

(2) Soil nutrients: Available soil nutrients depend largely on organic matter content, soil texture and the type of parent material.

(3) Salinity: Soil salinity is influenced by the type of parent material, internal drainage and soil texture.

Each range site has its own characteristics which result in a specific plant community or a level of productivity that make it different from other range sites. In practice, range sites for a particular region are commonly **determined** on the basis of the following criteria:

(1) differences in the dominant plant species in the "climax" or original plant community;

(2) differences in the proportion of the most important species in the "climax" plant community.

(3) differences in the total annual yield of the "climax" plant community.

B.2 Range Site Description

Within a climatic zone or region, range sites may be grouped into the following categories mainly on the basis of the soil moisture regime:

(1) Normal upland sites: Normal uplands reflect the normal response to the climate of the region. The soil moisture regime here is considered average for that climate. The Saskatchewan upland sites are: sands, sandy, loamy and clayey.

(2) Other range sites: Due to significant variations in topography, drainage or type of parent material, certain range sites are characterized by drier or wetter moisture regimes than the normal uplands. Examples of areas receiving greater than average moisture are wetlands and saline lowlands. Sites that exhibit lower than average moisture include gravel, saline upland and steep slopes.

The following is a brief description of some of the range sites found in Saskatchewan:

B.3 Normal Upland Sites

(1) Sands: These are nearly level to rolling land with deep, loose, coarse-textured soils (coarse to very fine sands). This site is characterized by very weak soil development and high wind erosion hazard. Permeability is rapid and water holding capacity is low. Common soils classified as sands range site include undifferentiated sand, regosolic sands and loamy sands.

(2) Sandy: These are nearly level to rolling land with somewhat finer soil texture than in the previous site (fine sandy loam, loamy fine sands, loamy very fine sands). The soil is darker than the in the preceding site reflecting greater soil development. Permeability is moderate to rapid and available water capacity is moderate. The potential for soil erosion by wind erosion is relatively high. Examples of this include Chaplin sandy loam, Biggar sandy loam and other light loam soils.

(3) Loamy: Loamy sites include gently undulating to rolling uplands with medium to moderately fine-textured soils (loam, clay loam). The soils are deep and well to moderately well drained. Examples of soils included in this site are Haverhill loam, Weyburn loam and Oxbow loam.

(4) Clayey: These are nearly level to rolling uplands with moderately deep, well-drained, fine textured soils (e.g., clay, heavy clay). This site is mostly associated with glacial lake plains (lacustrine plains). Clayey sites include Sceptre clay and Elstow clay soils and other fine - textured soils.

B.4 Range Sites with Drier Moisture Regime

(1) Dune Sands: The dune sand site is characterized by very rough topography with deep, coarse-textured soils (loose sands). Little or no soil development is noted in this site. Soils grouped under this site include Dune Sands, Antelope

Regosol, and Vera regosol. Sand dunes with only sparse vegetation cover are considered unsuitable for grazing.

(2) Burnouts: These are nearly level lands with moderately fine to moderately coarse-textured soils underlain by dense, slowly permeable subsoil that is high in sodium. This site occurs mainly in the southwestern corner of the province (solonetzic soils such as the Echo Association).

(3) Thin Upland or Shallow: These include shallow soils with various textures occurring on steep slopes. The weakly developed soils characteristics of this site restrict plant rooting. Soil water holding capacity is low. Examples of this include soils mapped as "eroded" and the rough phases of the "Dissected Plateau Complex", and Hillwash complex.

(4) Gravelly: These are coarse-textured soils with high gravel content (>50%). The soils of the shallow-to-gravel range site is underlain by gravel at approximately 40 cm or less. They are associated with glacial outwash or stream-eroded till. An example is Biggar gravelly loam.

(5) Saline Upland: Saline upland site is characterized by high content of soluble salts and occurs on nearly level to depressional topography. Soils are poorly drained and weakly developed. Although salt tolerant plants are present in large amounts, many upland species are still important. Salt may appear on soil surface in dry periods.

(6) Badlands: This site is characterized by a mosaic of nonvegetated, highly eroded areas and vegetated "islands". The vegetated areas may resemble the normal uplands but are

not large enough to map separately. Productivity is extremely low. Examples include the Killdeer and Big Muddy badlands.

B.5 Range Sites Receiving Above Average Moisture

(1) Wetlands and Overflow Sites: Marshy lands with surface water remaining during part of the growing season. Soils are deep but poorly drained and are too wet to cultivate. Subirrigated sites are low-lying wetlands, but usually with no surface water appearing during the growing season. Saskatchewan wetlands show extremely high variability in terms of species composition and productivity.

(2) Saline Lowlands: These are poorly drained saline wetlands receiving additional water from seepage or overflow. Salt tolerant plants supply the bulk of the production.

(3) Closed Depression: These are shallow upland depressions and basins which occasionally receive a relatively small amount of runoff. This is usually included in a complex with the dominant upland site due to its small areal extent.

APPENDIX C
STOCKING RATE GUIDE

**Table C.1. Recommended Stocking Rates (AUM/acre) for the Dry Areas
in the Brown Soil Zone.**

RANGE SITES	RANGE CONDITION			
	EXCELLENT	GOOD	FAIR	POOR
Clayey	0.25	0.20	0.16	0.13
Loamy	0.25	0.20	0.16	0.13
Sandy	0.20	0.16	0.13	0.10
Sand	0.20	0.16	0.13	0.10
Dune sand	0.15	0.12	0.10	0.08
Burnout	0.15	0.12	0.10	0.08
Saline upland	0.15	0.12	0.10	0.08
Closed depression	0.40	0.32	0.25	0.21
Thin	0.15	0.12	0.10	0.08
Badland	0.08	0.06	0.05	0.04
Gravelly	0.15	0.12	0.10	0.08
Shallow-to-gravel	0.15	0.12	0.10	0.08
Limy	0.15	0.12	0.10	0.08
Saline lowland	0.25	0.20	0.16	0.13
Wetland	0.60	0.48	0.38	0.30

Table C.2. Recommended Stocking Rates (AUM/acre) for the Moist Area in the Brown Soil Zone.

RANGE SITES	RANGE CONDITION			
	EXCELLENT	GOOD	FAIR	POOR
Clayey	0.35	0.28	0.22	0.17
Loamy	0.35	0.28	0.22	0.17
Sandy	0.30	0.24	0.19	0.15
Sand	0.30	0.24	0.19	0.15
Dune sand	0.20	0.16	0.13	0.10
Burnout	0.20	0.16	0.13	0.10
Saline upland	0.20	0.16	0.13	0.10
Closed depression	0.50	0.40	0.32	0.25
Thin	0.20	0.16	0.13	0.10
Badland	0.10	0.08	0.06	0.04
Gravelly	0.20	0.16	0.13	0.10
Shallow-to-gravel	0.20	0.16	0.13	0.10
Limy	0.20	0.16	0.13	0.10
Saline lowland	0.35	0.28	0.22	0.17
Wetland	0.70	0.56	0.45	0.36

Table C.3. Recommended Stocking Rates (AUM/acre) for Nonwooded Areas
in the Dark Brown Soil Zone.

RANGE SITES	RANGE CONDITION			
	EXCELLENT	GOOD	FAIR	POOR
Clayey	0.45	0.36	0.29	0.23
Loamy	0.45	0.36	0.29	0.23
Sandy	0.40	0.32	0.26	0.21
Sand	0.40	0.32	0.26	0.21
Dune sand	0.30	0.24	0.19	0.15
Burnout	0.25	0.20	0.16	0.13
Saline upland	0.25	0.20	0.16	0.13
Closed depression	0.60	0.40	0.32	0.25
Thin	0.25	0.16	0.13	0.10
Badland	0.20	0.08	0.06	0.04
Gravelly	0.25	0.20	0.16	0.13
Shallow-to-gravel	0.25	0.20	0.16	0.13
Limy	0.25	0.20	0.16	0.13
Saline lowland	0.45	0.36	0.29	0.23
Wetland	0.80	0.64	0.51	0.41

Table C.4. Recommended Stocking Rates (AUM/acre) for Nonwooded Areas
in the Black Soil Zone.

RANGE SITES	RANGE CONDITION			
	EXCELLENT	GOOD	FAIR	POOR
Clayey	0.55	0.44	0.35	0.28
Loamy	0.55	0.44	0.35	0.28
Sandy	0.45	0.36	0.29	0.23
Sand	0.45	0.36	0.29	0.23
Dune sand	0.30	0.24	0.19	0.15
Burnout	0.30	0.24	0.19	0.15
Saline upland	0.30	0.24	0.19	0.15
Closed depression	0.70	0.56	0.45	0.36
Thin	0.30	0.24	0.19	0.15
Gravelly	0.30	0.24	0.19	0.15
Shallow-to-gravel	0.30	0.24	0.19	0.15
Limy	0.30	0.24	0.19	0.15
Saline lowland	0.55	0.44	0.35	0.28
Wetland	0.90	0.72	0.58	0.46

Table C.5. Recommended Stocking Rates* (AUM/acre) for Wooded Areas

VEGETATION OR SITE	SOIL ZONE			
	Dark Brown	Black	Dark Gray	Gray
ASPEN				
Normal upland	0.12	0.20	0.26	0.26
Dune sand	0.12	0.20	0.26	0.26
Closed depression	0.20	0.25	0.30	0.30
Thin	NA	0.10	0.15	0.20
CLEARED				
Nonseeded	NA	--	0.40	0.40
OTHERS				
Wetland	NA	NA	0.40	0.40

* Rates are for stands in satisfactory condition. Although formal rating of range condition is not used here, an indication of condition can be obtained from the relative abundance of the decreasers. (see plant list).

NA: not applicable, see the previous two tables.

-- No data or sites are not common.

APPENDIX D
RESPONSE OF RANGE PLANTS
TO PROLONGED HEAVY GRAZING

Appendix D. Response of Main Saskatchewan Range Plants
to Continued Heavy Grazing.

	BROWN	DARK BROWN	BLACK-GRAY
(1) GRASSES			
Alkali cord grass	INCREASER	INCREASER	INCREASER
Bearded wheatgrass	DECREASER	DECREASER	DECREASER
Big bluestem	-	DECREASER	DECREASER
Blue grama	INCREASER	INCREASER	INCREASER
Canada reed grass	INCREASER	INCREASER	INCREASER
Canada wildrye	DECREASER	DECREASER	DECREASER
Early bluegrass	INCREASER	INCREASER	INCREASER
Fowl blue grass	DECREASER	DECREASER	DECREASER
Fowl manna grass	DECREASER	DECREASER	DECREASER
Fringed brome grass	DECREASER	DECREASER	DECREASER
Green needlegrass	DECREASER	DECREASER	DECREASER
Hair grass	INVADER	INVADER	INVADER
Hairy wildrye	-	-	INCREASER
Hooker's oatgrass	DECREASER	DECREASER	DECREASER
Indian rice grass	DECREASER	DECREASER	DECREASER
Intermediate oatgrass	-	INCREASER	INCREASER
June grass	INCREASER	INCREASER	INCREASER
Kentucky bluegrass	INVADER	INVADER	INVADER
Little bluestem	INCREASER	INCREASER	INCREASER
Mat muhly	INCREASER	INCREASER	INCREASER
Narrow reed grass	DECREASER	DECREASER	DECREASER
Needle-and-thread	DECREASER	INCREASER	INCREASER
Northern awnless brome	-	DECREASER	DECREASER
Northern reed grass	DECREASER	DECREASER	DECREASER
Northern wheatgrass	DECREASER	DECREASER	INCREASER
Nuttall alkali grass	DECREASER	DECREASER	DECREASER
Plains muhly	INCREASER	INCREASER	INCREASER
Plains reed grass	INCREASER	INCREASER	INCREASER
Porcupine grass	-	DECREASER	DECREASER
Prairie dropseed	DECREASER	DECREASER	DECREASER
Purple oat grass	-	DECREASER	DECREASER
Rough fescue	DECREASER	DECREASER	DECREASER
Salt grass	INCREASER	INCREASER	INCREASER
Sand dropseed	DECREASER	DECREASER	DECREASER
Sand grass	INCREASER	INCREASER	INCREASER
Sandberg's bluegrass	INCREASER	INCREASER	INCREASER
Sheep fescue	INCREASER	INCREASER	INCREASER
Side-oats grama	-	DECREASER	DECREASER
Slender wheatgrass	DECREASER	DECREASER	INCREASER
Slough grass	INCREASER	INCREASER	INCREASER
Spangle top	DECREASER	DECREASER	DECREASER
Sweet grass	-	INCREASER	INCREASER

	BROWN	DARK BROWN	BLACK-GRAY
(1) GRASSES continued..			
Switch grass	DECREASER	DECREASER	DECREASER
Tall manna grass	DECREASER	DECREASER	DECREASER
Western porcupine grass	DECREASER	DECREASER	INCREASER
Western wheatgrass*	DECR/INCR	DECR/INCR	INCREASER
White-grained rice grass	-	DECREASER	DECREASER
Wild barley	INVADER	INVADER	INVADER
(2) GRASSLIKE PLANTS			
Awned sedge	DECREASER	DECREASER	DECREASER
Baltic rush	INCREASER	INCREASER	INCREASER
Beaked sedge	-	DECREASER	DECREASER
Graceful sedge	DECREASER	DECREASER	DECREASER
Low sedge	INCREASER	INCREASER	INCREASER
Penn or sun-loving sedge	INCREASER	INCREASER	INCREASER
Thread-leaved sedge	INCREASER	INCREASER	INCREASER
(3) FORBS			
Beardtongue	INCREASER	INCREASER	INCREASER
Bedstraw	INCREASER	INCREASER	INCREASER
Black-eyed susan	INCREASER	INCREASER	INCREASER
Blazing aster	DECREASER	DECREASER	DECREASER
Broomweed	INVADER	INVADER	INVADER
Cactus	INCREASER	INCREASER	-
Canada thistle	INVADER	INVADER	INVADER
Club moss	INCREASER	INCREASER	INCREASER
Common peppergrass	INVADER	INVADER	INVADER
Cream-colored vetchling	-	DECREASER	DECREASER
Crocus	INCREASER	INCREASER	INCREASER
Dandelion	INVADER	INVADER	INVADER
Death camas	INCREASER	INCREASER	INCREASER
Everlasting	INVADER	INVADER	INVADER
Gaillardia	INCREASER	INCREASER	INCREASER
Goatsbeard	INVADER	INVADER	INVADER
Golden aster	INCREASER	INCREASER	INCREASER
Golden bean	INCREASER	INCREASER	INCREASER
Graceful goldenrod	INCREASER	INCREASER	INCREASER
Gumweed	INVAD/INCR	INVADER	INVADER
Ironplants	INCREASER	INCREASER	INCREASER
Lamb's quarters	INVADER	INVADER	INVADER
Leafy spurge	INVADER	INVADER	INVADER
Locoweeds	INCREASER	INCREASER	INCREASER
Long-headed coneflower	INCREASER	INCREASER	INCREASER
Low goldenrod	INCREASER	INCREASER	INCREASER
Meadow rue	INCREASER	INCREASER	INCREASER
Milkvetches	INCREASER	INCREASER	INCREASER

(3) FORBS continued..

	BROWN	DARK BROWN	BLACK-GRAY
Moss phlox	INCREASER	INCREASER	INCREASER
Plains wormwood	INCREASER	INCREASER	INCREASER
Prairie coneflower	INCREASER	INCREASER	INCREASER
Prairie sage	INCREASER	INCREASER	INCREASER
Purple prairie clover	DECREASER	DECREASER	DECREASER
Reflexed rock cress	INCREASER	INCREASER	INCREASER
Scarlet mallow	INCREASER	INCREASER	INCREASER
Silky or silvery lupine	INCREASER	INCREASER	INCREASER
Skeleton weed	INCREASER	INCREASER	INCREASER
Smooth aster	INCREASER	INCREASER	INCREASER
Solomon's seal	INCREASER	INCREASER	INCREASER
Sweet-broom	INCREASER	INCREASER	INCREASER
Three-flowered avens	INCREASER	INCREASER	INCREASER
Vetches	DECREASER	DECREASER	DECREASER
White prairie aster	INCREASER	INCREASER	INCREASER
Wild licorice	INCREASER	INCREASER	INCREASER
Wild peavine	-	DECREASER	DECREASER
Woolly yarrow	INCREASER	INCREASER	INCREASER
Yellow avens	INCREASER	INCREASER	INCREASER

(4) SHRUBS AND TREES

Aspen poplar	-	INVAD/INCREAS	INVAD/INCREAS
Chokecherry	DECREASER	DECREASER	DECREASER
Currant	-	-	INCREASER
Fringed sage	INCREASER	INCREASER	INCREASER
Greasewood	INCREASER	INCREASER	-
Green alder	-	-	INCREASER
Low bush-cranberry	-	DECREASER	DECREASER
Nuttall's saltbush	DECREASER	DECREASER	DECREASER
Pin cherry	-	DECREASER	DECREASER
Prairie rose	INCREASER	INCREASER	INCREASER
Prickly rose	INCREASER	INCREASER	INCREASER
Red-osier dogwood	-	DECREASER	DECREASER
Saskatoon	DECREASER	DECREASER	DECREASER
Shrubby cinquefoil	INCREASER	INCREASER	INCREASER
Silver sage	INCREASER	INCREASER	INCREASER
Western snowberry	INCREASER	INCREASER	INCREASER
Willow	INCREASER	INCREASER	INCREASER
Winterfat	DECREASER	DECREASER	DECREASER
Wolfwillow	INCREASER	INCREASER	INCREASER
Wood's rose	INCREASER	INCREASER	INCREASER

* Status varies with range sites

APPENDIX E
RANGELAND INVENTORY SHEETS

NAME OF RANCHING UNIT: _____ DATE: _____
FIELD NUMBER: _____ TOTAL AREA: _____ acres
RANGE SITE: _____ SITE AREA: _____ acres
RANGE TYPE: _____ SOIL ZONE: _____
SOIL TYPE: _____ TOPOGRAPHY: _____

[illegible]

Average Cover (%)
Clubmoss Cover (%)
Bare Ground (%) •

RANGE CONDITION: Rating -----	% Class -----	MANAGEMENT AND IMPROVEMENT
RECOMMENDED STOCKING RATE:	AUM/acre	POTENTIAL:
TOTAL ANIMAL UNIT MONTHS FOR SITE:	AUM	-----
UTILIZATION CUT (%):		-----
UTILIZATION CUT (AUM):		-----
INITIALLY ADJUSTED STOCKING RATE:	AUM	-----

APPENDIX F
RANGE CONDITION GUIDE

Appendix F.1. Guide to Range Condition of Grasslands in the Brown Soil Zone

(1) INCREASEASERS

Maximum contribution (%) to original vegetation (dry-weight basis)

	Wetland	Sub- Irrigated	Overflow	Saline lowland	Sands	Sandy	Loamy	Clayey	Dune sand	Gravel uplands	Thin uplands	Saline uplands	Burnouts	Badlands
Needle-and-thread			10		35	25	20	10	30	30	d	d	d	d
Blue grama					5	10	5	5	5	5	5		20	15
Sandberg's bluegrass								5		10	10	d	5	d
June grass					5	5	5	25	10	10	10		10	10
Plains reedgrass				5		5	5			10	10	d	10	d
Sand grass				15	10				15					
Western wheatgrass		20	d	d	d	d	d	30	d	d	d	d	d	d
Plains muhly										5	5	5	5	5
Mat muhly												5		
Salt grass		5		10								25		61
Sedge increasers	25	15	5	5	5	5	5	5	5	10	10		5	d
Baltic rush				5										
Western snowberry		10	5					5						
Fringed sage					5	5	5	5	5	5	5		5	5
Silver sage			5		5				10					5
Greasewood				10						5	5			d
Other woody increaser	15	10	10		10	5		5	20	5	5		5	5
Forb increasers	5						5	5	5	5	5	5	5	5

d: decrease

(2) DECREASEASERS

Northern wheatgrass
Green needlegrass
Slender wheatgrass
Rough fescue
Western porcupine grass

(3) INVADERS

Wild barley
Gumweed
Dan. feline
Lamb's quarters
Goat's beard
Broomweed
Leafy spurge
All other annuals
All other exotics

Appendix F.2. Guide to Range Condition of Grasslands in the Dark Brown Soil Zone

(1) INCREASESERS

Maximum contribution (%) to original vegetation (dry-weight basis)

	Wetland	Sub- Irrigated	Overflow	Saline lowland	Sands	Sandy	Loamy	Clayey	Dune sand	Gravel	Thin upland	Saline upland
Needle-and-thread			5		20	15	10	10	25	25	d	d
Blue grama						5	5	5		10	10	10
Sandberg's bluegrass								5		10	10	10
June grass							5	5	10	10	10	
Plains reedgrass										5	d	
Sand grass					15	15			20		10	
Western wheatgrass	15		30	d	d	d	30	20	d	d	d	d
Plains muhly						5				5	5	5
Mat muhly		5	5	10								5
Little bluestem										5		
Sedge increasers	40	20	5	5	5	5	5		5	5	10	
Kentucky bluegrass	5	5	5			5	5	5				
Western snowberry					5			5		5		
Fringed sage					5	5	5	5		5	5	
Silver sage			5	5					10		5	
Woody increasers	10				10	5	5	5	10			
Forb increasers	10							5	5		5	5

d: decrease

(2) DECREASESERS

Rough fescue
Green needlegrass
Western porcupine gra
Sideoats grama
Porcupine grass
Switch grass

Slender wheatgrass
Northern wheatgrass
Bearded wheatgrass
Indian rice grass
Sand dropseed
Winterfat

(3) INVADERS

Wild barley
Gumweed
Dandelion
Lamb's quarters
Russian thistle
Broomweed

Canada thistle
Leafy spurge
All other annuals
All other exotics

Appendix F.3. Guide to Range Condition of Grasslands in the Black Soil Zone.

(1) INCREASESERS

Maximum contributions (%) to original vegetation (dry-weight basis)

	Wetland	Sub-irrigated	Overflow	Saline lowland	Sand	Sandy	Loamy	Clayey	Gravel	Thin uplands
Western porcupine grass					25	20	10	10		
June grass					5	5	5	5	10	10
Wheatgrasses		10	25	10	5	5	10	5	d	d
Intermediate oatgrass						5	5	5	5	5
Plains muhly									5	5
Salt grass				10					5	5
Sedge increasers	20	10	10	5	5	5	5	5	5	5
Shrubby cinquefoil					5				10	5
Forb increasers	5	5	5	5	5	5	5	5	5	5
Woody increasers	15	10	10		10	5	5	5	5	5

d: decreaseers

(2) DECREASEASERS

Rough fescue
Green needlegrass
Slender wheatgrass
Vetches
Hedysanum

(3) INVADERS

Sheep fescue
Wild barley
Hair grass
Kentucky bluegrass
Canada thistle

Dandelion

All other annuals

All other exotics

APPENDIX G

LIST OF MAIN SASKATCHEWAN RANGE PLANTS

Appendix G. Common and Scientific Names of Some Saskatchewan
Range Plants

(1) GRASSES

Alkali cord grass	<i>Spartina</i> spp.
Bearded wheatgrass	<i>Agropyron subsecundum</i>
Big bluestem	<i>Andropogon gerardi</i>
Blue grama	<i>Bouteloua gracilis</i>
Canada reed grass	<i>Calamagrostis canadensis</i>
Canada wildrye	<i>Elymus canadensis</i>
Early bluegrass	<i>Poa cusickii</i>
Fowl blue grass	<i>Poa palustris</i>
Fowl manna grass	<i>Glyceria striata</i>
Fringed brome grass	<i>Bromus ciliatus</i>
Green needlegrass	<i>Stipa viridula</i>
Hair grass	<i>Agrostis scabra</i>
Hairy wildrye	<i>Elymus innovatus</i>
Hooker's oatgrass	<i>Helictotrichon hookeri</i>
Indian rice grass	<i>Oryzopsis hymenoides</i>
Intermediate oatgrass	<i>Danthonia intermedia</i>
June grass	<i>Koeleria cristata</i>
Kentucky bluegrass	<i>Poa pratensis</i>
Little bluestem	<i>Andropogon scoparius</i>
Mat muhly	<i>Muhlenbergia richardsonis</i>
Narrow reed grass	<i>Calamagrostis neglecta</i>
Needle-and-thread	<i>Stipa comata</i>
Northern awnless brome	<i>Bromus pumpellianus</i>
Northern reed grass	<i>Calamagrostis inexpansa</i>
Northern wheatgrass	<i>Agropyron dasystachyum</i>
Nuttall alkali grass	<i>Puccinellia nuttalliana</i>
Plains muhly	<i>Muhlenbergia cuspidata</i>
Plains reed grass	<i>Calamagrostis montanensis</i>
Porcupine grass	<i>Stipa spartea</i>
Prairie dropseed	<i>Sporobolus heterolepis</i>
Purple oat grass	<i>Schizachne purpurascens</i>
Rough fescue	<i>Festuca scabrella</i>
Salt grass	<i>Distichlis stricta</i>
Sand dropseed	<i>Sporobolus cryptandrus</i>
Sand grass	<i>Calamovilfa longifolia</i>
Sandberg's bluegrass	<i>Poa secunda</i>
Sheep fescue	<i>Festuca ovina</i>
Side-oats grama	<i>Bouteloua curtipendula</i>
Slender wheatgrass	<i>Agropyron trachycaulum</i>
Slough grass	<i>Beckmannia syzigachne</i>
Spangle top	<i>Scolochloa festucacea</i>
Sweet grass	<i>Hierochloa odorata</i>

(1) GRASSES continued..

Switch grass	<i>Panicum virgatum</i>
Tall manna grass	<i>Glyceria grandis</i>
Western porcupine grass	<i>Stipa curtiseta</i>
Western wheatgrass	<i>Agropyron smithii</i>
White-grained rice grass	<i>Oryzopsis asperifolia</i>
Wild barley	<i>Hordeum jubatum</i>

(2) GRASSLIKE PLANTS

Awed sedge	<i>Carex atherodes</i>
Baltic rush	<i>Juncus balticus</i>
Beaked sedge	<i>Carex rostrata</i>
Graceful sedge	<i>Carex praegracilis</i>
Low sedge	<i>Carex eleocharis</i>
Penn or sun-loving sedge	<i>Carex pennsylvanica</i>
Thread-leaved sedge	<i>Carex filifolia</i>

(3) FORBS

Beardtongues	<i>Penstemon</i> spp.
Bedstraw	<i>Galium boreale</i>
Black-eyed susan	<i>Rudbeckia hirta</i>
Blazing aster	<i>Liatris punctata</i>
Broomweed	<i>Gutierrezia sarothrae</i>
Cactus	<i>Opuntia</i> spp.
Canada thistle	<i>Cirsium arvense</i>
Club moss	<i>Selaginella densa</i>
Common peppergrass	<i>Lepidium densiflorum</i>
Cream-colored vetchling	<i>Lathyrus ochroleucus</i>
Crocus	<i>Anemone patens</i>
Dandelion	<i>Taraxacum officinale</i>
Death camas	<i>Zygadenus gramineus</i>
Everlasting	<i>Antennaria</i> spp.
Gaillardia	<i>Gaillardia aristida</i>
Goatsbeard	<i>Tragopogon dubius</i>
Golden aster	<i>Chrysopsis villosa</i>
Golden bean	<i>Thermopsis rhombifolia</i>
Graceful goldenrod	<i>Solidago canadensis</i>
Gumweed	<i>Grindelia squarrosa</i>
Horsetails	<i>Equisetum</i> spp.
Ironplants	<i>Haplopappus</i> spp.
Lamb's quarters	<i>Chenopodium album</i>
Leafy spurge	<i>Euphorbia esula</i>
Locoweeds	<i>Oxytropis</i> spp.
Long-headed coneflower	<i>Ratibida columnifera</i>

(3) FORBS continued.

Low goldenrod	<i>Solidago missouriensis</i>
Meadow rue	<i>Thalictrum venulosum</i>
Milkvetches	<i>Astragalus</i> spp.
Moss phlox	<i>Phlox hoodii</i>
Plains wormwood	<i>Artemisia campestris</i>
Prairie coneflower	<i>Ratibida columnifera</i>
Prairie sage	<i>Artemisia ludoviciana</i>
Purple prairie clover	<i>Petalostemon purpureus</i>
Reflexed rock cress	<i>Arabis retrofracta</i>
Scarlet mallow	<i>Malvastrum coccineum</i>
Silky or silvery lupine	<i>Lupinus argenteus</i>
Skeleton weed	<i>Lygodesmia juncea</i>
Smooth aster	<i>Aster laevis</i>
Solomon's seal	<i>Smilacina stellata</i>
Sweet-broom	<i>Hedysarum</i> spp.
Three-flowered avens	<i>Geum triflorum</i>
Vetches	<i>Vicia</i> spp.
White prairie aster	<i>Aster falcatus</i>
Wild licorice	<i>Glycyrrhiza lepidota</i>
Wild peavine	<i>Lathyrus venosus</i>
Woolly yarrow	<i>Achillea lanulosa</i>
Yellow avens	<i>Geum allepicum</i>

(4) SHRUBS AND TREES

Aspen poplar	<i>Populus tremuloides</i>
Chokecherry	<i>Prunus virginiana</i>
Currant	<i>Ribes</i> spp.
Fringed sage	<i>Artemisia frigida</i>
Greasewood	<i>Sarcobatus vermiculatus</i>
Green alder	<i>Alnus crispa</i>
Low bush-cranberry	<i>Viburnum edule</i>
Nuttall's saltbush	<i>Atriplex nuttallii</i>
Pin cherry	<i>Prunus pensylvanica</i>
Prairie rose	<i>Rosa arkansana</i>
Prickly rose	<i>Rosa acicularis</i>
Red-osier dogwood	<i>Cornus stolonifera</i>
Saskatoon	<i>Amelanchier alnifolia</i>
Shrubby cinquefoil	<i>Potentilla fruticosa</i>
Silver sage	<i>Artemisia cana</i>
Western snowberry	<i>Symphoricarpos occidentalis</i>
Willow	<i>Salix</i> spp.
Winterfat	<i>Eurotia lanata</i>
Wolfwillow	<i>Elaeagnus commutata</i>
Wood's rose	<i>Rosa woodsii</i>